Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

SUMMARIES OF PRE-CAMBRIAN LITERATURE OF NORTH AMERICA FOR 1909, 1910, 1911, AND PART OF 1912

EDWARD STEIDTMANN
University of Wisconsin

CONTENTS

I. General
    1909
    1910
    1911
II. Eastern Part of North America
III. Lake Superior Region and Isolated pre-Cambrian Areas of the Mississippi Valley
IV. Ontario, Northwest Territories, and East Coast of Hudson Bay
V. Quebec
VI. The Cordilleras

I. GENERAL

1909

Adams[1] maintains that the pre-Cambrian may be divided on the basis of major diastrophic movements into Eo, Meso, and Neo-Proterozoic, and that this basis may serve the purpose of international correlation better than comparative study of unconformities. He objects to the two fold classification of the pre-Cambrian suggested by Van Hise, on the ground that the break at the base of the Animikie is as great as that which follows the Keewatin.

Adams[2] states that amphibolites consisting of aggregates of hornblende, pyroxene, mica, and other minerals, in various proportions, have developed from (*a*) the metamorphism and recrystallization of impure calcareous sediments; (*b*) alteration of certain basic dikes; and (*c*) alteration of limestones by batholithic intrusions of granite. The granites show marginal digestion of limestones grading into a mosaic of hornblende and feldspar crystals. With diminishing hornblende the gradation passes into a pyroxene, scapolite, biotite rock, and finally into coarse crystalline limestone.

---

[1] F. D. Adams, "The Basis of pre-Cambrian Correlation," *Jour. Geol.*, XVII, No. 2 (1909), 105–23.

[2] F. D. Adams, "Origin of Amphibolites of the Laurentian Area of Canada," *Jour. Geol.*, XVII, No. 1 (1909), 1–18.

From analyses of limestones representing three stages of alteration to amphibolite near a contact, Adams concludes that the alteration has involved the introduction from the granite of silica, alumina, iron, magnesia, and alkalies, and the loss of lime and carbonic acid. This conclusion seems to rest on the assumption that the alteration took place without change of mass.

Lindgren[1] presents a résumé on the principal epochs of the segregation of metals on the North American continent. Many different epochs of ore formation are embraced in the pre-Cambrian period (in many different places). In the eastern part of the continent iron, copper, nickel, silver, and gold ores occur in association with a variety of both intrusive and extrusive igneous rocks ranging from granite to basalt. In the Cordilleran region, intrusives, principally granites, are almost exclusively represented. Intrusive diorite, gabbro, and diabase are present. The Cordilleran pre-Cambrian ores are principally gold and silver. The lead and zinc ores of the pre-Cambrian are unimportant.

Van Hise[2] maintains that the bases of classification of the pre-Cambrian should be physical, those of most importance being: (1) lithologic character, (2) continuity of formations, (3) likeness of formations, (4) like sequence of formations, (5) subaerial or subaqueous deposits, (6) unconformities, (7) relations to series of known age, (8) relations with intrusive rocks, (9) amount of deformation, (10) degree of metamorphism. His major divisions of the pre-Cambrian are Archaean and Algonkian.

1910

Adams[3] concludes that large igneous intrusives rising from the deeper portions of the earth are one of the principal agents of the metamorphism of rocks, since more and more cases of intimate relationship between the occurrence of schists and batholithic intrusions, principally granite, have been found as geologic study proceeds.

---

[1] Waldemar Lindgren, "Metallogenetic Epochs," *Econ. Geol.*, IV, No. 5 (1909), 409–420.

[2] C. R. Van Hise, "Principles of Classification and Correlation of the pre-Cambrian Rocks," *Jour. Geol.*, XVII, No. 2 (1909), 97–104.

[3] Frank D. Adams, "The Origin of the Deep-seated Metamorphism of the pre-Cambrian Crystalline Schists," *Compte Rendu*, Congrès Géologique International, 1910, pp. 563–72.

Coleman[1] presents a summary of the stratigraphy and correlation of the pre-Cambrian as adopted by the international committees on correlation, before the British Association at Winnipeg.

Coleman[2] argues that the abundance of carbonaceous shales, limestones, and other ordinary sediments in the Keewatin of Ontario implies the existence of life and climatic conditions not unlike the present.

Coleman[3] infers that uniformitarian conditions prevailed in the pre-Cambrian from the similarity of pre-Cambrian sediments to those of later periods.

Coleman[4] presents a summary on the degree and kind of metamorphism of the various pre-Cambrian formations of northern Ontario. The agents of metamorphism as outlined by Coleman are heat, pressure, and solutions.

Coleman[5] presents a historic summary of the methods which have been employed in classifying the Archaean of Ontario. The principal methods, according to Coleman, in the order of their historic development are relative stratigraphic position of formations, lithologic similarity, unconformity, eruptive contact, and basal conglomerates.

Coleman[6] summarizes the principal known events in the history of the Canadian shield.

[1] A. P. Coleman, "The pre-Cambrian Rocks of Canada," *British Assoc. Adv. Sci. Rept.* 79th Meeting, 1910, pp. 474–75.

[2] A. P. Coleman, "Climate and Physical Conditions of the Keewatin," *Geol. Soc. Am. Bull.*, XXI, No. 4 (1910), 778–79.

[3] A. P. Coleman, "The Bearing of pre-Cambrian Geology on Uniformitarianism," *British Assoc. Adv. Sci. Rept.*, 79th Meeting, 1910, pp. 473–74.

[4] A. P. Coleman, "Metamorphism in the pre-Cambrian of Northern Ontario," *Compte Rendu*, Congrès Géologique International, 1910, pp. 607–16.

[5] A. P. Coleman, "Methods of Classification of the Archaean of Ontario." *Compte Rendu*, Congrès Géologique International, 1910, Vol. I, pp. 721–33.

[6] A. P. Coleman, "The History of the Canadian Shield," *Nature*, LXXXIV (September 15, 1910), 333–39.

R. A. Daly[1] believes that the pre-Cambrian ocean probably contained less lime than the present ocean, for the following reasons: the sea must have been fresh or nearly fresh initially; the pre-Cambrian rivers probably carried less lime because the lands of that time did not possess the great development of limestone of the present; the lime contributed to the sea was probably precipitated by ammonium carbonate generated through the decay of organisms which accumulated on the sea bottom because of the lack of scavengers. The field evidence which he cites in favor of this hypothesis is the fineness of grain of many undisturbed pre-Cambrian dolomites which he believes is indicative of chemical precipitation, and the general scarcity of fossils in pre-Cambrian rocks, which he ascribes to the lack of lime in the sea from which organisms could obtain the materials for shells and hard parts.

Evans[2] believes that the sudden appearance of the Cambrian fauna may have been due to causes very similar to those which gave rise to the sudden appearance of the Tertiary fauna. These periods were preceded by great uplift of the lands, vulcanism, and widespread aridity. The record of the evolution of life immediately preceding them is therefore largely lost or inaccessible.

Harder[3] states that the pre-Cambrian manganese ores of the United States are found in association with the hematite deposits of the Lake Superior region; as manganiferous zinc ores at Franklin Furnace, N.J.; and in the metamorphic rocks of the Piedmont region of Virginia, North Carolina, South Carolina, and Georgia.

Hayes[4] states that the pre-Cambrian iron ores of the Lake Superior region furnish about 80 per cent of the annual ore production of the United States.

The iron formations from which the ores were derived are sedimentary deposits, consisting mainly of cherty iron carbonates, ferruginous cherts, and ferrous silicate rocks interbedded with clastics and extrusives. Their average iron content ranges from about 25 to 35 per cent iron. The ores were developed by the solution and removal of silica, and the oxidation, solution, transportation, and redeposition of the iron, in the exposed portions of the formations, having structural peculiarities favorable to the circulation of water, such as jointing, pitching basements, faults, etc.

---

[1] R. A. Daly, "Some Chemical Conditions in the pre-Cambrian Ocean," *Compte Rendu*, XI. Congrès Géologique International, 1910, pp. 503–9.

[2] John W. Evans, "The Sudden Appearance of the Cambrian Fauna," *Compte Rendu*, XI. Congrès Géologique International, pp. 543–46.

[3] Edmund Cecil Harder, "Manganese Deposits of the United States with Sections on Foreign Deposits, Chemistry, and Uses," *Bull. 427, U.S. Geological Survey*, 1910, pp. 298.

[4] C. W. Hayes, "Iron Ores of the United States," *Bull. 394, U.S. Geological Survey*, 1910, pp. 76–84.

The ores mined are mainly hematite and limonite, although some magnetite has been developed through deep-seated conditions of high pressure and temperature. Their iron content, while steadily falling, has generally been above 50 per cent, but 40 per cent ores are now mined as mixers for higher-grade materials. The estimated tonnage of the available ores, including all ores above 55 per cent iron, and 25 per cent of all formations containing from 45 to 55 per cent iron is 3,500,000,000 tons. Iron formations containing from 35 to 45 per cent iron are classed as available in the future. Their tonnage is enormous, 72,000,000,000 tons being taken as an arbitrary estimate.

The pre-Cambrian Adirondack area of New York contains commercial deposits of non-titaniferous magnetites, titaniferous magnetites, and red hematites.

The non-titaniferous magnetites are intimately associated with sedimentary rocks, marble, schists, and gneisses. Separation is generally made by magnetic methods and the ore shipped to the iron centers, excepting a small tonnage which is smelted in local coke ovens. The ores are both Bessemer and non-Bessemer. The lowest grades contain about 35 per cent iron when mined, the richest from 60 to 65 per cent. The concentrates run from 60 to 65 per cent. No fair estimate of the tonnage can be made. The known deposits of high grade are believed to contain 35,000,000 tons, and the leaner deposits carrying over 35 per cent iron may yield 75,000,000 tons of concentrates.

The ores are believed to have been developed in connection with the intrusion of igneous rocks.

The titaniferous magnetites carry at least 8 per cent of titanic acid and on an average about 15 per cent. They are found at the margins of a gabbro-anorthosite area, and are spoken of as magmatic segregations. The richest ores contain about 60 per cent iron. They are not used at present because of their titanium content, excepting on a very small scale. Their extent is unknown. In the Lake Sanford district alone, 90,000,000 tons are known.

Karl L. Henning[1] reviewed the principal results of Van Hise and Leith's *Pre-Cambrian Geology of North America.*

Kemp[2] states that the following tentative chronologic table of the Swedish pre-Cambrian based on the work of Sederholm and Högbom is finding favor:

Upper or Jotnian	Epijotnian dislocations
	Jotnian
	Subjotnian land surface denudation and igneous rocks
Middle or Jatulian	Epijatulian folding
	Jatulian
	Subjatulian land surface and denudation
Lower or Archaean	Serarchaean granites
	Archaean
	No chronological subdivision. Difference due to varying metamorphism

Kemp shows that the Archaean of Sweden is separable into two major divisions, an older complex of minor sediments and major deep-seated intrusives, and a younger series of intrusive granites consisting of four distinct types. Similarly, the Archaean of the Lake Superior region embraces an older division consisting of minor sediments and major igneous rocks, mostly basic extrusives, however, and a younger division consisting almost entirely of granitic intrusives. The sediments of the Swedish Archaean contain squeezed conglomerates, crystalline limestones and dolomites, mica schists, leptites, garnet, cordierite, sillimanite, and graphite gneisses of probable sedimentary origin. The leptites are fine-grained, banded, and stratified rocks, which include sediments and iron ores. The Archaean sediments of the older division in the Lake Superior region include iron formation and minor clastics. The Archaean igneous rocks of Sweden of the older division comprise granites, gneisses, and gneissoid intrusives, titaniferous ore-bearing gabbros, syenites, and anorthosites. The leptites, sediments, and iron ores are compared by Kemp to channels amid an archipelago of large island intrusives.

---

[1] Karl L. Henning, "Die pro-kambrische Geologie von Nord Amerika," *Naturwissenschaftliche Wochenschrift,* N.F., Bd. No. 28 (July, 1910), pp. 433–37.

[2] J. F. Kemp, "Comparative Sketch of the pre-Cambrian Geology of Sweden and New York," *New York State Museum Bull. 149,* 1910, pp. 93–119.

The surface on which the Jatulian was deposited is regarded as hilly by Högbom and mountainous by Törnebohm. Kemp believes that the time gap of erosion which separated the Jatulian from the Archaean was not so long as the one which separated the Cambrian from the Jotnian or the Jotnian from the Jatulian. The Jatulian in Sweden consists of quartzite, schists, dolomitic limestones, and beds of anthracite, which have a maximum thickness of two meters.

Professor Sederholm has divided the Jatulian of Finland into an upper and lower member which consist of eruptives, greenstones, clastics, and dolomites, and has compared it to the Upper Huronian of the Lake Superior region. The Jatulian closed with a period of very intense folding, followed by intrusions of a peculiar porphyritic granite which decomposes readily, forming the so-called *rapakivi*, Finnish for rotten stone. This has afforded an important guide by which Swedish geologists have measured the age of various other intrusives and metamorphic rocks. The erosion which followed developed an even floor free from weathering products, on which the Jotnian diabases and ripple-marked and sun-cracked sandstones were deposited. These now lie in isolated patches. They are compared by Professor Kemp to the Torridonian of Scotland and the Keweenawan of the Lake Superior region. Finally, Cambro-Silurian sediments of which widespread relicts remain were deposited upon a generally even surface covered with a weathering breccia which grades downward into a kaolinized gneiss. So-called sandstone dikes containing Cambrian fossils are found in gneisses far from Cambrian beds.

Most of the comparisons made by Professor Kemp between the pre-Cambric of Sweden and New York are necessarily petrographic and appeal to those who are personally familiar with the rocks of the New York pre-Cambrian.

Lane[1] finds that the grain of Laurentian granites tends to be uniform from the margin to the center, from which he infers that the country rock which the granites invaded must have been nearer the condition of crystallization or fusion than the granites, and that the Laurentian granites are batholiths rather than re-fused sediments or portions of the original crust of the earth.

---

[1] A. C. Lane, "The Stratigraphic Value of the Laurentian," *Compte Rendu*, XI. Congrès Géologique International, 1910, pp. 633–37.

Lindgren[1] states that the principal pre-Cambrian ores of North America are iron, copper, nickel, gold, and silver. The iron ore types are: magnetite and ilmenite of igneous origin, and hematites of sedimentary and igneous origin, which have been concentrated by surface waters. The copper, nickel, and silver of the Lake Superior region and the copper ores of the South are connected with basic igneous rock. The gold quartz veins of the south are related to granitic intrusions.

Newland[2] states that the iron ores mined in Sweden are all pre-Cambrian magnetites associated with crystalline schists and acid igneous rocks. There are also some low-grade, gabbroic, titaniferous magnetite silicate rocks, and bog lake deposits, the latter famous as exemplifications of present-day ore deposition, but these are not mined.

Most of the ore comes from central Sweden. A considerable portion of this is unique for its low phosphorus content, and because of its exceptional qualities can be mined from very small deposits on a miniature scale. The ore is reduced in charcoal furnaces. Nearly half of the output of central Sweden is high phosphorus ore from Grangesberg. The high phosphorus ores are all exported, since there are no coals in Sweden suitable for furnaces. The ores of central Sweden occur in association with sediments, leptites, and gneisses which form winding lenses between massive intrusives. The ores at Norberg and Striberg consist of banded magnetite quartz rocks with a sedimentary aspect.

The Kiruna and Gellivare magnetite apatite deposits of Lapland resemble the titaniferous ores of New York in their association with sodic rocks. The ores at Gellivare are lenses, bands, and chimneys in syenite, the entire mass showing regional metamorphism. The ores at Kiruna are of the nature of large dikes between igneous rocks. The largest, that of Kurunavaara, is 5 kilometers long and from 50 to 164 meters thick, and lies between a quartz porphyry hanging wall and syenite porphyry foot. The ore has a dense, steely appearance, and consists of magnetite with a little apatite. They are probably igneous in origin because of the igneous character of the wall rocks, the igneous texture of the ore, the presence of apatite dikes in the ore and wall rock, and the existence of apophyses of ore in the footwall and the surrounding porphyry.

---

[1] W. Lindgren, "Metallogenetic Epochs," *Jour. Can. Min. Inst.*, XII (1910), 102–13.

[2] D. H. Newland, "Notes on the Geology of the Swedish Magnetites," *New York State Museum Bull. 149*, 1910, pp. 107–19.

Sederholm[1] believes that certain pre-Cambrian graphitic schists and limestones indicate the existence of progonozoique forms. The progonozoique formations alluded to are the formations which contain vestiges of the ancestral forms of the life which suddenly appears in the Cambrian.

Sollas[2] ascribes the scarcity of fossils in the pre-Cambrian to a feeble development of hard parts in the organisms of that period. From the rough approximation that "the ontogeny of the individual repeats the phylogeny of the race," he infers that the organisms of the pre-Cambrian were similar to the larval forms of the existing invertebrata. Such larval forms are not known to have been preserved, notwithstanding that some are endowed with calcareous skeletons.

Walcott[3] accounts for the sudden appearance of abundant marine life with the Cambrian by assuming that marine life first developed in the open ocean and did not migrate to the shore zones until the Algonkian uplift preceding the Cambrian had largely excluded the seas from the continents.

Walther[4] ascribes the scarcity of fossils in certain pre-Cambrian formations immediately below the Cambrian to their deposition under desert conditions. He applies this hypothesis to the Algonkian of the Grand Canyon, the Torridonian sandstone of Scotland, and the Sparagmite formation of northern Scandinavia.

---

[1] J. J. Sederholm, "Sur les vestiges de la vie dans les formations progonozoique," *Compte Rendu,* XI. Congrès Géologique International, 1910, pp. 515–24.

[2] W. J. Sollas, "The Fauna of the Protaeon," *Compte Rendu,* XI. Congrès Géologique International, 1910, Vol. I, pp. 499–501.

[3] C. D. Walcott, "Abrupt Appearance of the Cambrian Fauna on the North American Continent," *Smithsonian Misc. Coll.,* LVII, No. 1 (1910), pp. 1–16, 1 pl., 1 fig.

[4] T. Walther, "Die lithologischen Eigenschaften der Gesteine im Liegenden der kambrischen Formations," *Compte Rendu,* XI. Congrès Géologique International, 1910, Vol. I, pp. 511–513.

Matthew[1] ascribes the sudden appearance of Cambrian life to the obliteration of fossils by chemical changes and other causes, partly to the absence or rarity of Benthos in the earlier faunas, and partly to the fact that fossiliferous strata beneath the Cambrian are arbitrarily attached to the base of the Cambrian.

1911

C. K. Leith and E. C. Harder[2] state that Brazilian hematite ores of Minas Geraes are found about 300 miles from the coast, in a region constituted by a basement complex of crystalline schists, upon which rests a sedimentary series consisting of slates, schists, quartzites, ferruginous quartzites or itabirites with interbedded hematite ores, gneiss, ferruginous carbonate rocks, carbonate rocks, and amphibolites. The sediments have been severely folded and altered by granitic intrusives. Near the bottom quartzite predominates. Argillaceous sediments predominate near the top and the iron ore beds are most abundant near the middle of the sedimentary series.

The most abundant ores of the district are thin-bedded, fine-grained hematites, of excellent grade. Thick-bedded, massive, nearly pure hematites rank next in importance.

A very large tonnage of fragmental ore consisting of residual hematite and more or less transported débris resulting from the breakdown of the ore deposits is in sight. These ores are cemented with sands, clays, and limonite and therefore are lower in grade than bedded deposits. A negligible quantity of ore is known to have developed from the leaching of ferruginous carbonates and itabirite.

The Lake Superior ores have resulted from primary deposition and secondary concentration. In no known case has primary deposition alone developed ore. All the ores are related to structural features which favored the circulation of water. In Brazil, the iron ores are the result of primary deposition, and while some secondary concentration by leaching has taken place, it is local and very subordinate. The fragmental ores of Brazil have no counterpart in the Lake Superior region excepting in conglomerates at the base of formations resting on ore deposits. Glacial erosion may have removed large quantities of fragmental ore in the Lake Superior region.

---

[1] G. F. Matthew, "The Sudden Appearance of the Cambrian Fauna," *Compte Rendu*, Congrès Géologique International, 1910, pp. 547–551,

[2] C. K. Leith and E. C. Harder, "Hematite Ores of Brazil and a Comparison with Hematite Ores of Lake Superior," *Econ. Geol.*, VI (1911), 670–86.

Miller[1] points out that certain pre-Cambrian stratigraphic units of the Northwest Highlands of Scotland are similar to some of Canada as indicated by the following table:

Canada	Scotland
A. Keweenawan.	A. Torridonian.
B. Huronian with intrusives.	B. Intrusives of Lewisan. A fragmental series of quartzite, etc., has been removed before Torridonian was deposited.
C. Keewatin-Laurentian Complex. Granite and gneiss, greenstone, limestone, iron formation, etc.	C. Lewisan. Fundamental Complex. Gneiss, hornblende and chloritic schists, limestone, and iron formation.

Miller and Knight[2] believe that the present use of the term Laurentian as applied to the granites and granite gneisses intrusive into the Keewatin but presumably not in the Lower Huronian may have led to poorly based correlations.

---

[1] W. G. Miller, "A Geological Trip in Scotland," *Ont. Bur. Mines, 20th Ann. Rept.*, 1911, pp. 259–69.

[2] W. G. Miller and C. W. Knight, "The Laurentian System," *Ont. Bur. of Mines, 20th Ann. Rept.*, 1911, pp. 280–84.

[*To be continued*]